BOOK REVIEWS

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Systematics, Ecology, and the Biodiversity Crisis.—N. Eldredge (ed.). 1992. Colombia University Press. $40.

It is not an elaborate advertising campaign, hoax, or political ploy. Awareness of the biodiversity crisis is compulsory for everyone on earth. The recent emergence of conservation biology as a profession in many countries (complete with university degrees) attests to the importance of being aware. Newly born out of desperate necessity, conservation biology draws upon numerous schools of thought, and has as many definitions, methods, and solutions as there are people involved in it.

Some popular ideas from the politico-economic cognoscenti remind me of a quip that I read in the British humor magazine *Punch* sometime in the late 1980's. If memory serves, the setting was a meeting where an administrative spokesman delivered a talk on policy regarding nature, and a paraphrase goes something like: "Nature is divided into three genera—animals, the weather, and plants. Animals contains three species: game, stock and vermin, and they can only be told apart when dead. If exterminated, it's vermin; if bagged, it's game, and if insured, it's stock." The question "What about butterflies?" was answered, "Vermin. There are no game insects." Such satire is not entirely without a basis in reality because we live in a world where money talks. Hence it is not surprising that proponents of the business school of conservation of biodiversity have perhaps the loudest public voice. However, can we literally buy our way out of the biodiversity crisis? Economics plays an important role in conservation, but in order to develop solutions to the biodiversity crisis the voices of organismal biologists need also to be heard. It is therefore heartening to see a volume composed of voices almost entirely from systematists and ecologists. The introduction indicates that this book covers three topics: 1) the different approaches ecologists and systematists have to biodiversity, 2) the recent interest in all biological fields in conservation biology, and 3) how the role of systematics can be enhanced with respect to the biodiversity crisis.

Chapter 1 concerns the separation of ecology and systematics. After a maze of jargon and definitions, Eldredge informs us that systematics deals with genealogy, and ecology deals with the economics of how organisms interact. The text that follows continues to point out that systematics and ecology are different, and that populations bridge economics and genealogy in nature. The chapter closes with, "We need now to see what factors of niche utilization at the population level produce characteristic genealogical patterns and which ecological patterns. There should be many interesting connections made in the coming years as we follow up these lines of thought" (p. 13). Did I miss something? Is this the obfuscation of an election year? If there was a main point to this chapter (besides the difference between ecology and systematics) it evaded me, as did the reason why this essay was included in a book about the biodiversity crisis. Eldredge may well ask, where does the twain of ecology and systematics meet? Certainly not in this chapter.

Chapter 2 addresses the tropical megafauna bias in conservation biology. Here

Platnick reiterates his intriguing idea that southern temperate zones may have a greater number of endemics than do the tropics, and crisply points out that biodiversity is synonymous with arthropods, not vertebrates. If areas of endemism are important considerations in conservation biology, then arthropod systematists are in the unique position to define areas for conservation efforts. Drawing on his own expertise he tells us that the biodiversity crisis is occurring just as strongly in the southern temperate zones as in the tropics, but the study of spiders doesn't tell us any more than butterflies or nematodes because the answers are the same—we don't know enough about arthropods to say how many there are or just what their ranges are—there simply are too few arthropod systematists. Nobody has a clue as to just how bad (or potentially good) things are—all we do know is that the world is composed mainly of arthropod species, many which are being extirpated without a trace. Can threatened species keep their toeholds, make a comeback after the long history they have had of human disturbance, or provide clues for their survival? Time may tell, but perhaps only if we take off the vertebrate colored glasses and start looking seriously at arthropods.

With the perspective of someone who has spent a lot of time in museums and in the field amongst live organisms, Chapter 3 examines the role of systematics and ecology in museums in understanding biodiversity. Tattersall's message is that we must **DO** something rather than talk about it. He suggests a "consultation of nature, rather than of navels" (p. 27) is required to understand biodiversity, and uses his work on Malagasay primates as an elegant example to show how systematics and ecology both provide important questions, answers, understanding, and future directions. I like this man. He sees clearly that the problem gives us little time to sit around and discuss definitional fluff—an advocate of deeds not words who is squarely on the side of nature and knowledge. Tattersall's closing comments provide reasons why symbiotic associations between ecologists and systematists have important roles to play in conservation biology at large, and in museums. We are left with the sobering thought that without active collaboration between the two disciplines that champion natural history, the biodiversity crisis may leave us with only history museums—mute testimonies to what was diversity.

Based on his previous work, Chapter 4 by Stevens advocates what he calls Rappaport's Rule as a subtly different hypothesis (from the 12 or so extant ones) of why there are so many species in the tropics. We are told that the reason the tropics contain so many species is that they are composed of significant proportions of the "living dead"—individuals that disperse into a particular habitat, become established at very low abundance, but cannot ever reproduce due to lack of other individuals to do it with. In other words, communities are organized differently in temperate and tropical latitudes, and the living dead are constantly going extinct in many tropical habitats. Stevens feels that these rare species will be the first to go extinct in threatened habitats, and thus not good choices for conservation efforts. The message for conservation biology seems twofold. First, focus conservation efforts on species common enough to reproduce, and preserve large tracts of habitats. Secondly, universities and museums should promote eco-tourism to help save tropical habitats. My experience suggests that, like cattle, tourists seriously degrade tropical habitats physically, and artificially bloat local economy by creating commercial demand for nature artifacts, land, and trinkets. Call me a pessimist, but I remain unconvinced that buying our

way out is the end-all answer—it may spread it around, but it seems a weak solution to the problem.

Cracraft's ambitious chapter 5 focuses on speciation and patterns of biospheric evolution, historical patterns of diversity, thermodynamics and transduction of energy, and the richness of extant tropical communities in terms of biomass. His detailed synthetic observations and analyses suggest that historically biomass is not at equilibrium, but typically increases when weather patterns allow warm, humid conditions to prevail. The implication is that should warm climates spread, the present global biomass of organisms would increase through tropical expansion (roll on global warming, roll on?). This chapter is a nice scientific synthesis, but unless one can take solace in the potential for increased biomass through time, it seems out of place in a volume directed at the biodiversity crisis.

In chapter 6, Sepkoski shows with fossil evidence that historically, marine biodiversity has demonstrated a continued increase, and uses these data to address present day concerns. During the earth's history of increasing biodiversity there have been differential expansions of particular groups at unequal rates, followed by extinctions of many phylogenetic lineages also at varying rates. Extinction events have been followed by recovery events that suggest a quasi or semi-quasi equilibrium states for global diversity. These events of increased phylogenetic diversity were likely to have been a function of local ecological processes as evolution requires pools of genomic material to stock communities that may diverge; phylogenetic diversity reflects local ecosystems. Sepkoski's historical message to the present world is clear: continued human disturbance will continue to alter the course of evolution, but if the disturbance is stopped, the world's biota may recover. However, recovery time will likely be measured in thousands or millions of years.

In chapter 7, Novacek points out how systematists are considered by the majority of the world as "a bunch of drawer pullers" (p. 102). We are reminded, however, of the connections systematics has to physiology, ecology, evolution, and that systematics provides a basis for much of the rest of the biological sciences. Although still a nascent field, systematists have described the 1.4 million species known to occur on earth, and estimates suggest there remain approximately 80 million yet to describe. The message of this chapter is that the skills of the systematists may have much to offer toward our understanding biodiversity. Are these surprising conclusions?

Stiassny in chapter 8 demonstrates what practicing systematists can do in the face of the biodiversity crisis. Using the fish family Cichlidae she illustrates how, in a triage situation, phylogenetic methods provide valuable insight into the evolution of the entire group, and a means of choosing which taxa to preserve. Her study indicates why in the African Cichlidae, a group bursting with endemic species, it may be more important to put conservation efforts into saving a phylogenetically basal taxon rather than other more derived ones. Stiassney in fact shows very nicely the vital role that museum-based systematics plays in the biodiversity crisis.

Chapter 9 finds Barrowclough showing the contributions museums and systematists make to biodiversity and conservation biology. He begins by pointing out the great disparity between how diverse a group actually is and how many taxonomists work on it, and then points out the fact that even though the ranks of taxonomists are thinning, proportionally few systematists are working on insects. The fact that institutions of higher learning passively observe the loss of systematists without striving

to rectify the situation is alarming, but in the face of a global biodiversity crisis it is damning. Speaking directly to the subject of what museums and systematists can do his suggestions include: start popularizing systematics, educating about its importance and what it can do in deciding where reserves should be placed and what taxa should be saved. This essay provides potential solutions to the biodiversity crisis that can be acted upon now, not tomorrow. But will institutions listen?

Chapter 10 by Winston begins with a brief but chilling list documenting how badly the marine environment has been degraded by human effluence. Her point is that although earth is a marine planet, humans treat it as a rubbish pit. Continuing a sadly common theme she reflects that we do not know much at all about the biodiversity of the oceans, that there are few working marine systematists, fewer positions available, and little funding to help understand marine environments. In the face of these discouraging practicalities Winston strongly recommends that museums and systematists increase public awareness, lean on the political machinery, and encourage advocacy for the environment. All practicing biologists, and anyone with common sense should recognize that her recommendations will help. However, will they?

Historical destruction and reconstruction on a local scale are treated in chapter 11. Taboada presents a case history of how 40 years of socio-economic factors severely affected the natural habitats of Cuba, and how socio-economic factors may help preserve and rebuild them. Pointing to a time when, "in 1959 there were more lawyers than biologists, veterinarians, chemists, physicists, and engineers of every kind, all taken together" (p. 172), Taboada indicates that after a long, rocky road there are now systematists and other scientists involved and concerned with understanding the biodiversity crisis in Cuba. This is good news. However, it should remind us that, as usual, conservation efforts come after a long history of human habitat destruction. Thus, our understanding of Cuba's very special flora and fauna must now be relegated to paleontology, a few organisms that escaped the holocaust, those that invaded after the holocaust, and the ecology of reconstructive gardening.

The first sentence of chapter 12 by Flesness reads, "There is not a solution to the catastrophe we are witnessing" (p. 178). This acknowledges what we all know—that this is serious, and everyone needs to help provide a variety of solutions. Flesness acknowledges that he does not have THE answers, but after enthusiastically telling us that zoos and botanical gardens are educational institutions of great importance, he provides three ideas of how systematists could help the administrators: study focal taxa, freely and actively disseminate knowledge about organisms, and make museum labels that include some computerized ecological information on it. Interesting suggestions, should some funding source magically appear to finance them, but do I detect a certain administrative naivete about the environment natural historians work in? Why preach to the converted? Naturalists and systematists, like artists, typically do what they do from an inner drive, not because it is lucrative or generously funded. It seems to me a more immediate and practical suggestion would be to use the talents of both systematists and institutions by calling for strong, innovative public programs that teach systematics and natural history along with simple demonstrations as to why people need to curb their runaway reproductive habits. After all, the lack of basic natural history education and reproductive common sense are central to the biodiversity crisis—aren't they?

Vanzolini's chapter 13 provides a history of the role systematics and museums

have played in our understanding and documentation of biodiversity. Fundamentally the reason we are aware of the biodiversity crisis is because of faunistic and floristic works traditionally done by systematists. His messages for the future are good: integrate ecological and evolutionary interactions into the systematist's tools (as they historically have been), repeatedly sample areas with the idea of monitoring change (both ecological and evolutionary), utilize the morphoclimatic domain system of habitat classification (versus the Holdridge system), and land preservation efforts should include areas surrounding the focal core area. The reminder that systematics and ecology should be viewed as a mutualistic interaction, and that institutions themselves must form symbioses among themselves has never been more timely. With over 40 years as a practicing museum systematist in an area of the world that contains a staggering number of species, I think Vanzolini does not have a political agenda, but the calm, good sense that years of experience provide.

The diverse collection of essays assembled here ranges over themes, opinions, and interpretations both old and new. Most acknowledge the seriousness of the biodiversity crisis, and the paucity of funding available for organismal biology at any level. Potential solutions to the crisis offered here span a normal distribution. Laurels to the doers and advocates of being involved with habitats and organisms, hope for eventual enlightenment to the talkers. To me the value of this volume is the public announcement that: 1) systematists from the Americas are sufficiently concerned to attempt providing solutions from their area of expertise, 2) institutions of higher education provide little encouragement to students interested in a career in systematic biology, even though it is central to understanding nature, and 3) institutions and naturalists of all persuasions need strongly to promote natural history as an educational imperative. In response to the question from the *Punch* article 'What about butterflies?', the answer is—they are representatives of the most diverse group of organisms in the world, the arthropods, and potentially the most useful group for generating solutions to the biodiversity crisis.

This book can provide professionals a new perspective about what some systematists and ecologists think about conservation biology and the biodiversity crisis. I liked this book, and without detracting from its value I suggest there are at least two alternatives to buying it. First, a donation to a favorite museum, a specialist journal, or practicing naturalist will certainly be utilized for understanding nature. Second, a favorite field guide given to a child—along with a few words about why knowing about natural history, museums, and the interplay of systematics and ecology is important—seems an elegant alternative. Ultimately the fate of biodiversity falls to what the inheritors of this scarred planet think and do. As donors we owe it to the young to pass on knowledge and inspiration about natural history that was gleaned from our mistakes, and those of our ancestors. Such things can be taught, but it is unlikely that they can be bought.—*P. J. DeVries, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.*